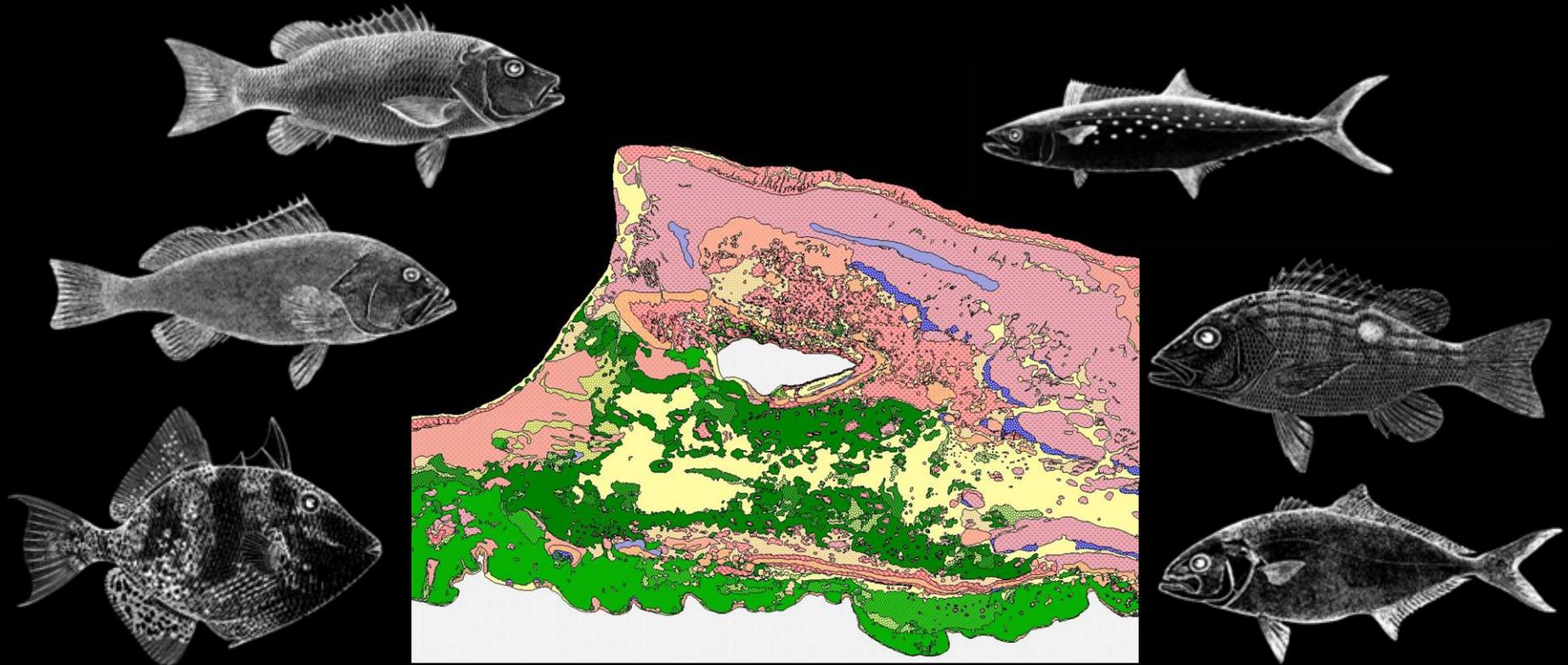


Seascape ecology of reef fish at Buck Island Reef National Monument, St.Croix, US Virgin Islands.



Matthew S. Kendall¹, Christopher Caldw¹, John D. Christensen¹, Michael Coyne¹, Christopher Jeffrey¹, Mark E. Monaco¹, Wendy Morrison¹, Jeanette Waddell¹, and Zandy Hillis-Starr²

1. NOAA/NOS/NCCOS/CCMA Biogeography Team
2. National Park Service

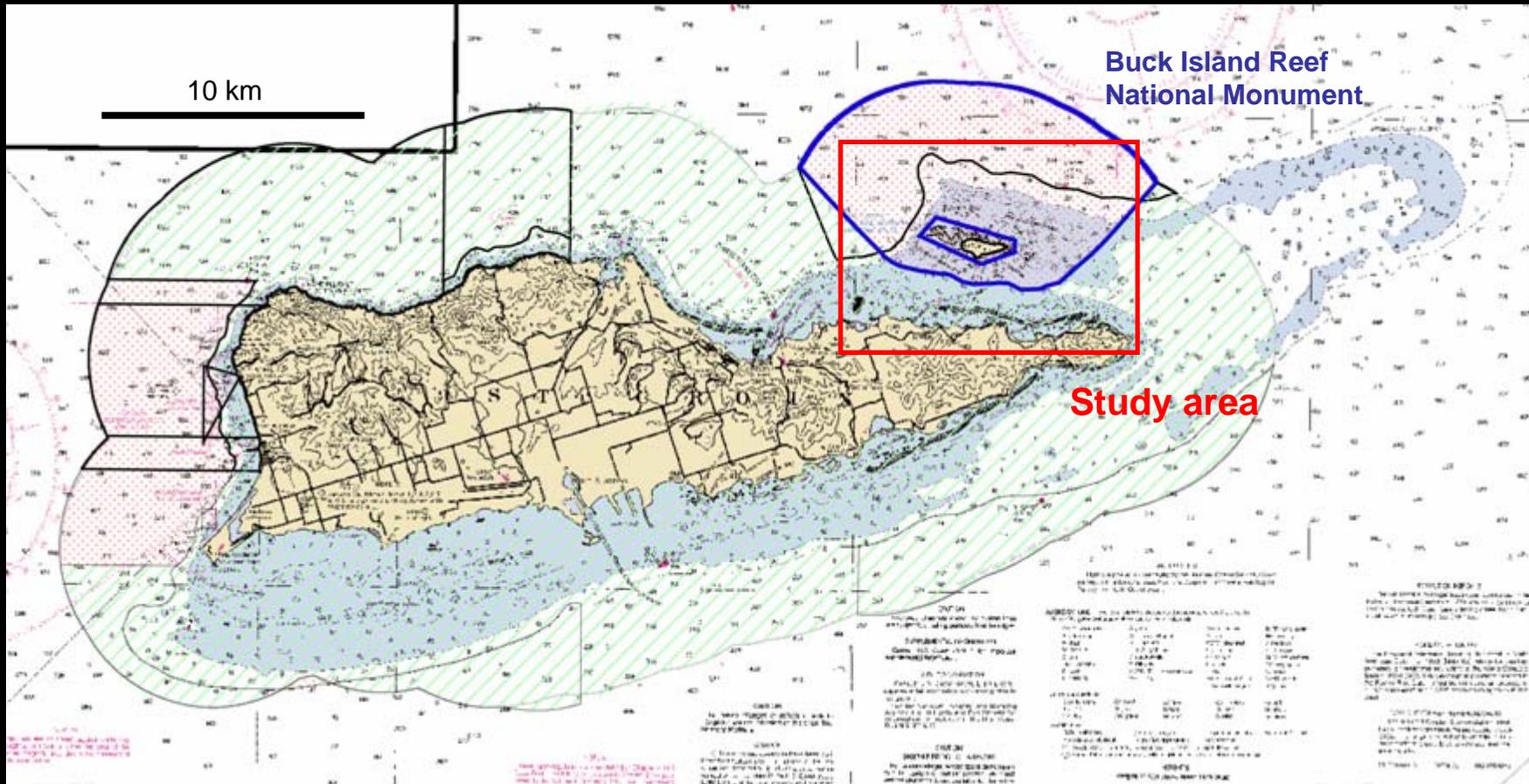


Overview

1. Establish a baseline inventory of reef fish
inside and outside Buck Island Reef NM
2. Describe a technique to identify patterns
between fish and their landscapes



Buck Island Reef National Monument, St.Croix USVI



Seascape ecology of reef fish at Buck Island Reef National Monument, St. Croix, US Virgin Islands

Buck Island Reef NM

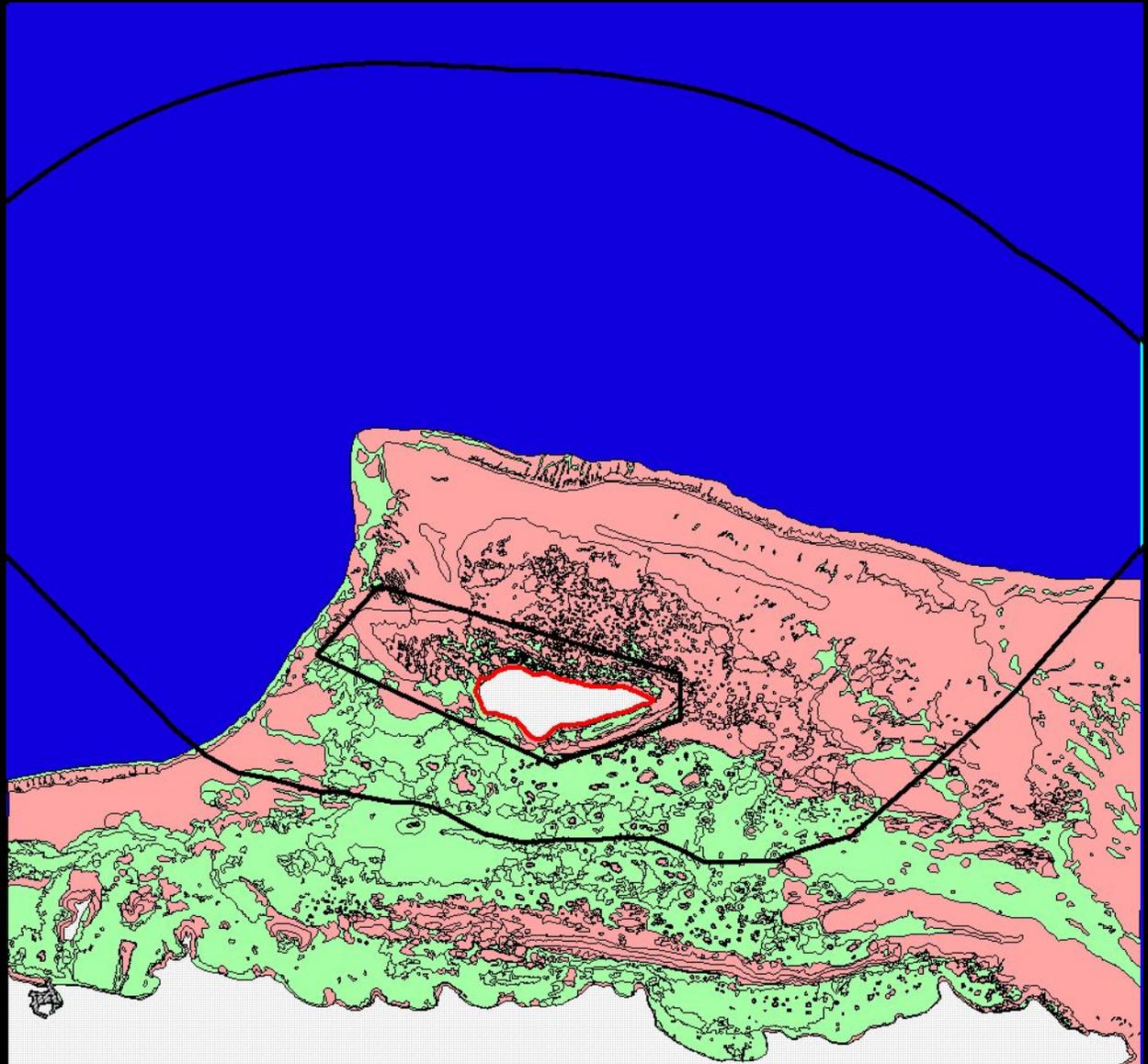
- Created in 1961 (4 km²)
- Expanded in 2001 (76 km²)

Benthic Maps

- Hierarchical classifications
- 1999 aerial photos
- Photo scale 1:48000
- Digitized at 1:6000
- Visual interpretation
- 100 m² MMU

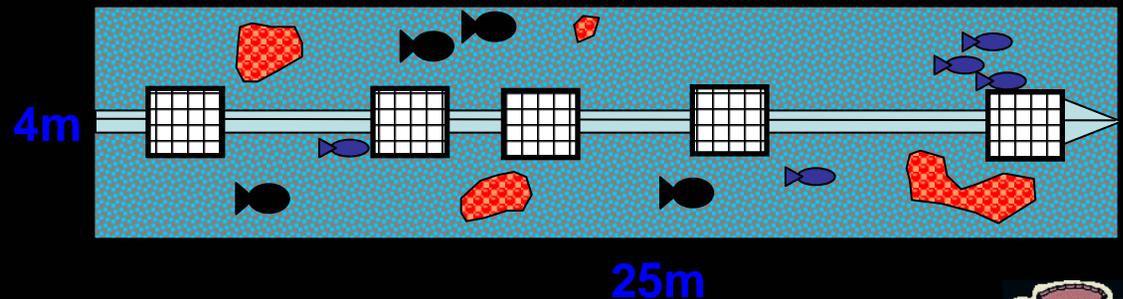
Inventory Strategy

- random stratified design
 - inside vs. outside park
 - hard vs. soft bottom



Fish Census Protocol

- Daytime surveys only
 - lat/long of starting point
 - point count
 - transect*
 - visual ID all fish species
 - count all individuals
 - estimate fork length to 5 cm
 - ~15 minute transect
 - count and measure conch
- Fine-scale habitat metrics
 - rugosity
 - biotic cover
 - abiotic cover



Preliminary Results of the Inventory:

461 surveys as of Sept '03

373 non-overlapping

Number of surveys
per stratum (Sept '03):

	Inside Park	Outside Park
Hard bottom	168	37
Soft bottom	168	---
		373

Total species richness by stratum:

	Inside Park	Outside Park
Hard bottom	135	86
Soft bottom	101	---

Total species richness :165

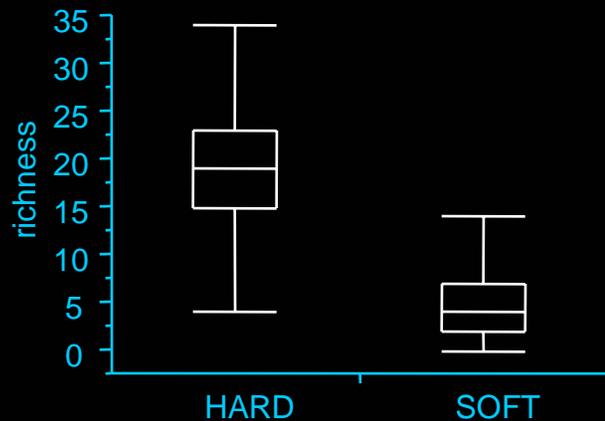
Species found on only inside HB: 57

Species found on only inside SB: 24

Species found on only outside HB: 6

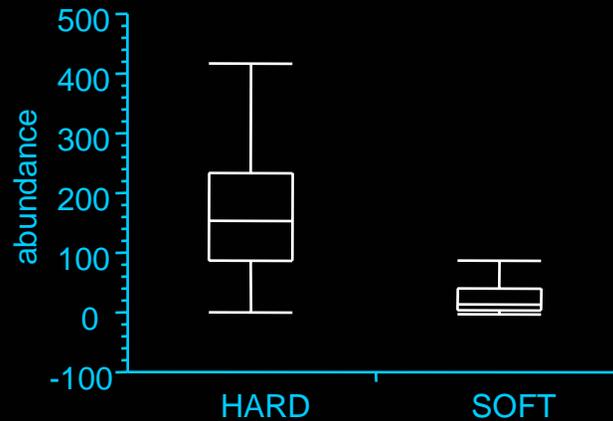


Preliminary Results of the Inventory: Inside BIRNM



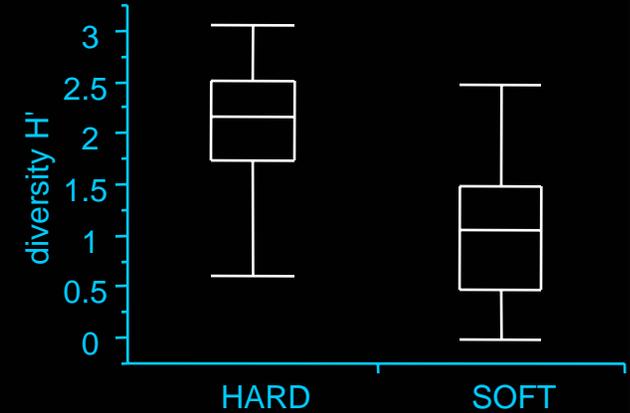
Wilcoxon / Kruskal-Wallis Test

ChiSquare	DF	Prob>ChiSq
207.2520	1	<.0001



Wilcoxon / Kruskal-Wallis Test

ChiSquare	DF	Prob>ChiSq
173.8375	1	<.0001



Wilcoxon / Kruskal-Wallis Test

ChiSquare	DF	Prob>ChiSq
157.5602	1	<.0001

Additional results are In Press at *Aquatic Conservation*
PCA, Cluster Analysis, Trophic Ratios, Density



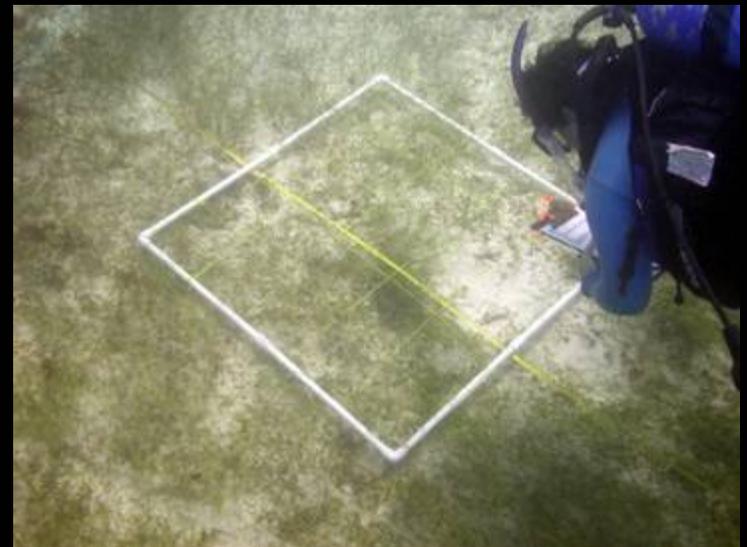
Overview

1. Establish a baseline inventory of reef fish
inside and outside Buck Island Reef NM
2. Describe a technique to identify patterns
between fish and their landscapes



Fine scale studies

- single bottom type
- 1m² quadrats
- fine-scale metrics
 - rugosity
 - live coral cover
 - algal cover
 - seagrass density
- intensive field work
- site specific
- limited management use

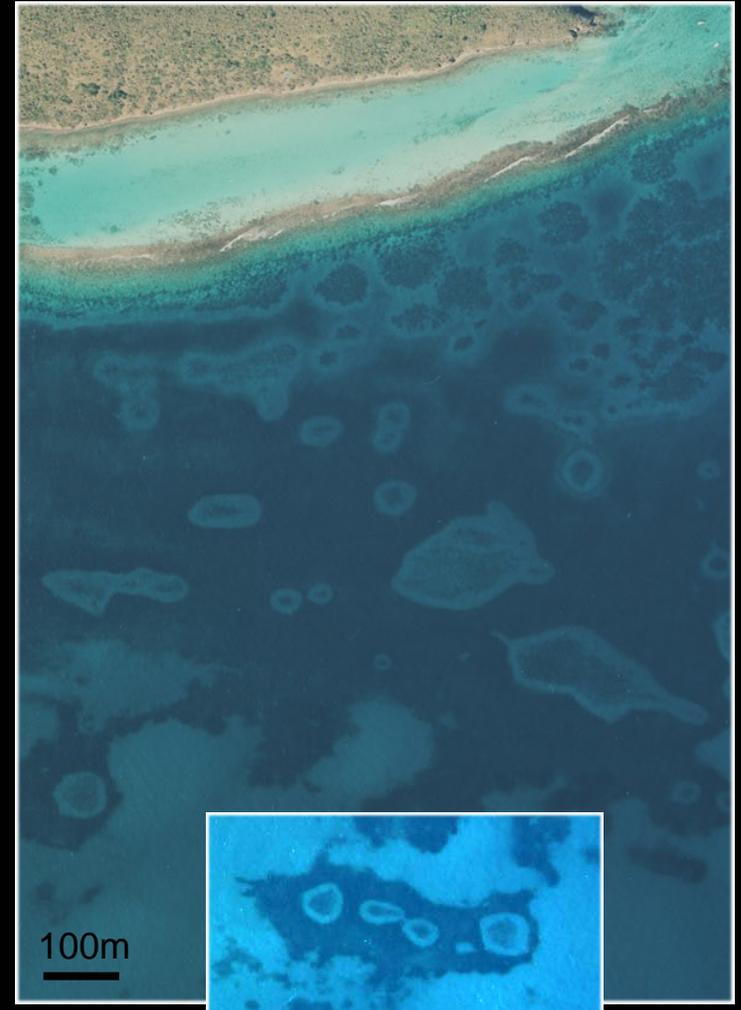


Broad scale processes are also at work

- seldom investigated
- multiple bottom types
- ecotones and edges
- patchy areas

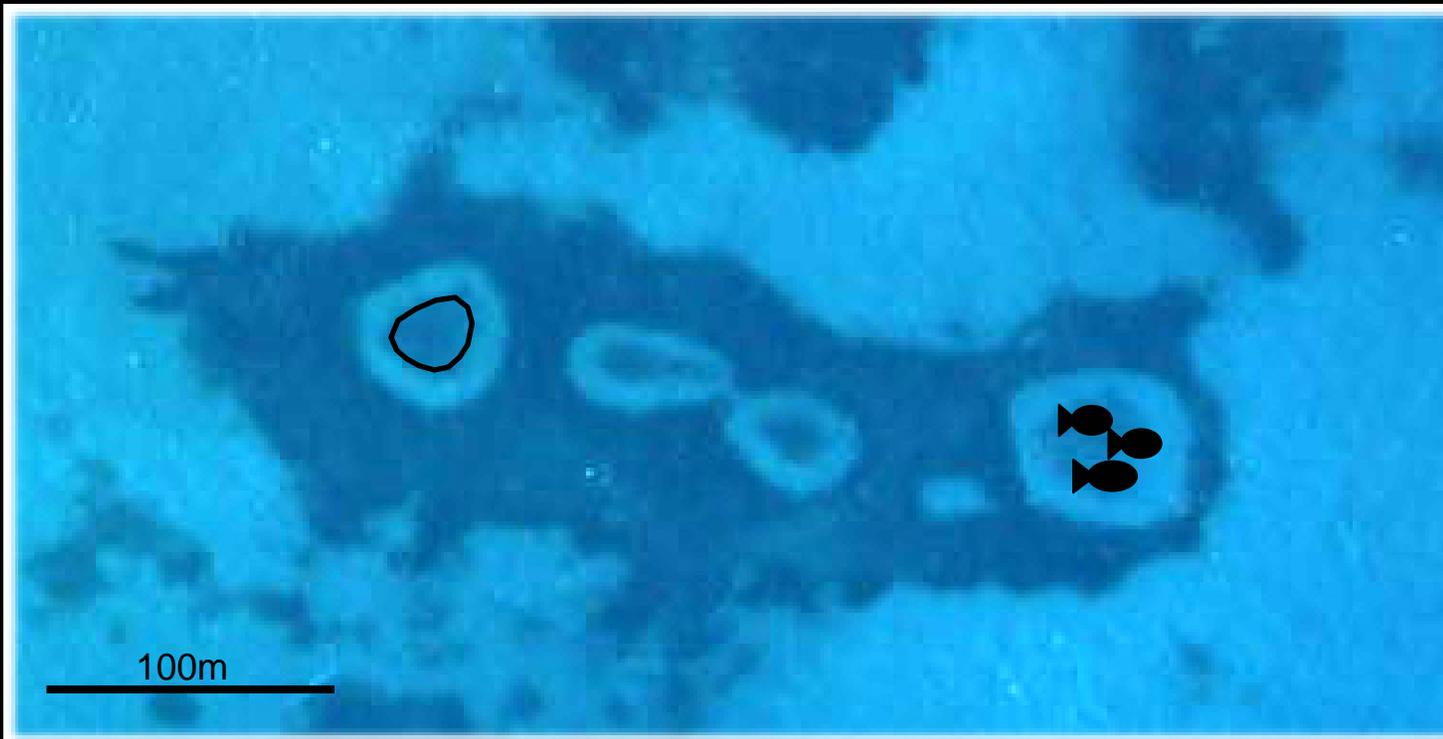
patch size
edge length
habitat diversity
neighborhood components

- regional relevance
- good management potential



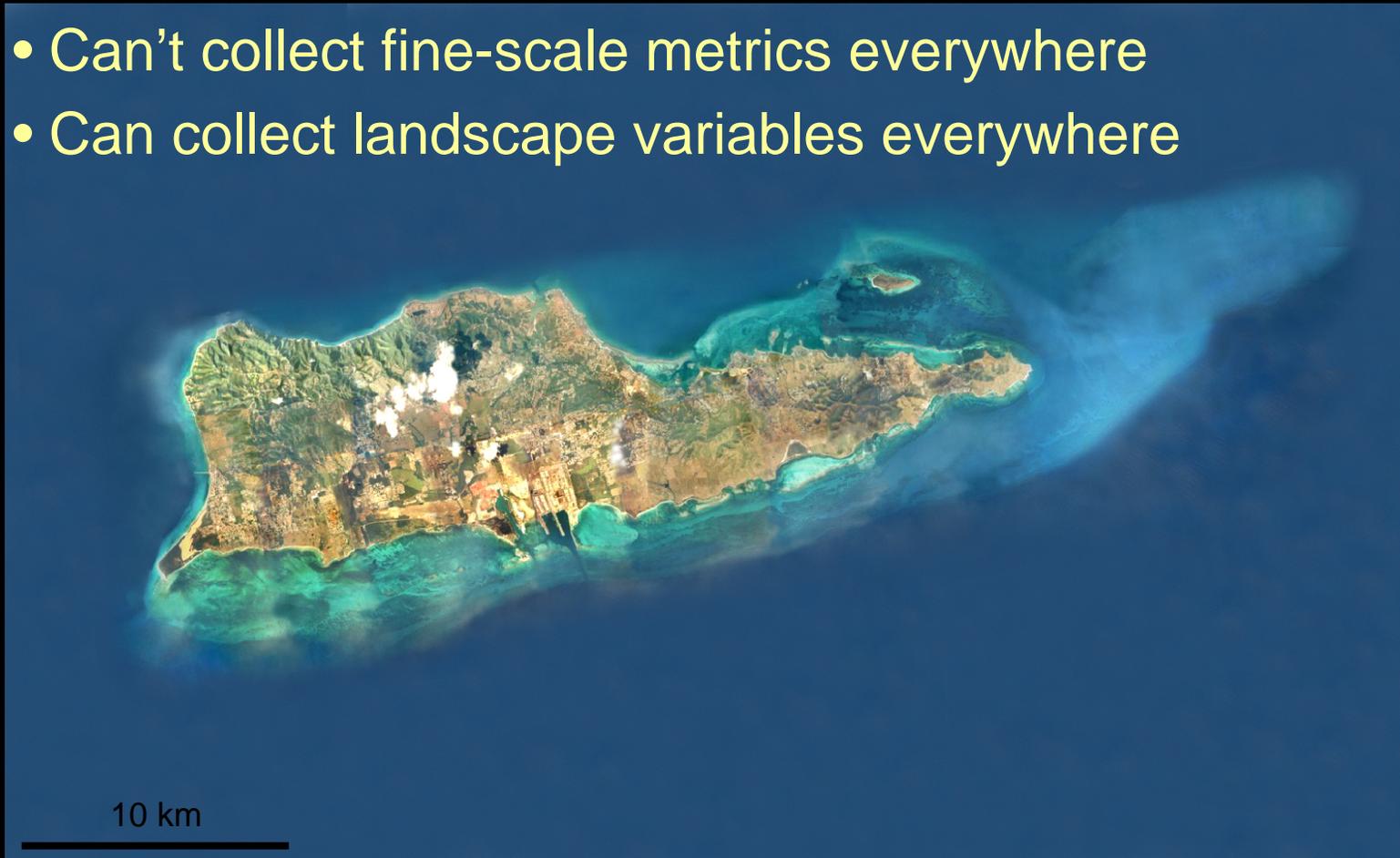
Evidence and examples of broad scale processes

- fish and invertebrates grazing seagrass
- haemulids nightly foraging
- lutjanid and carangid cruising

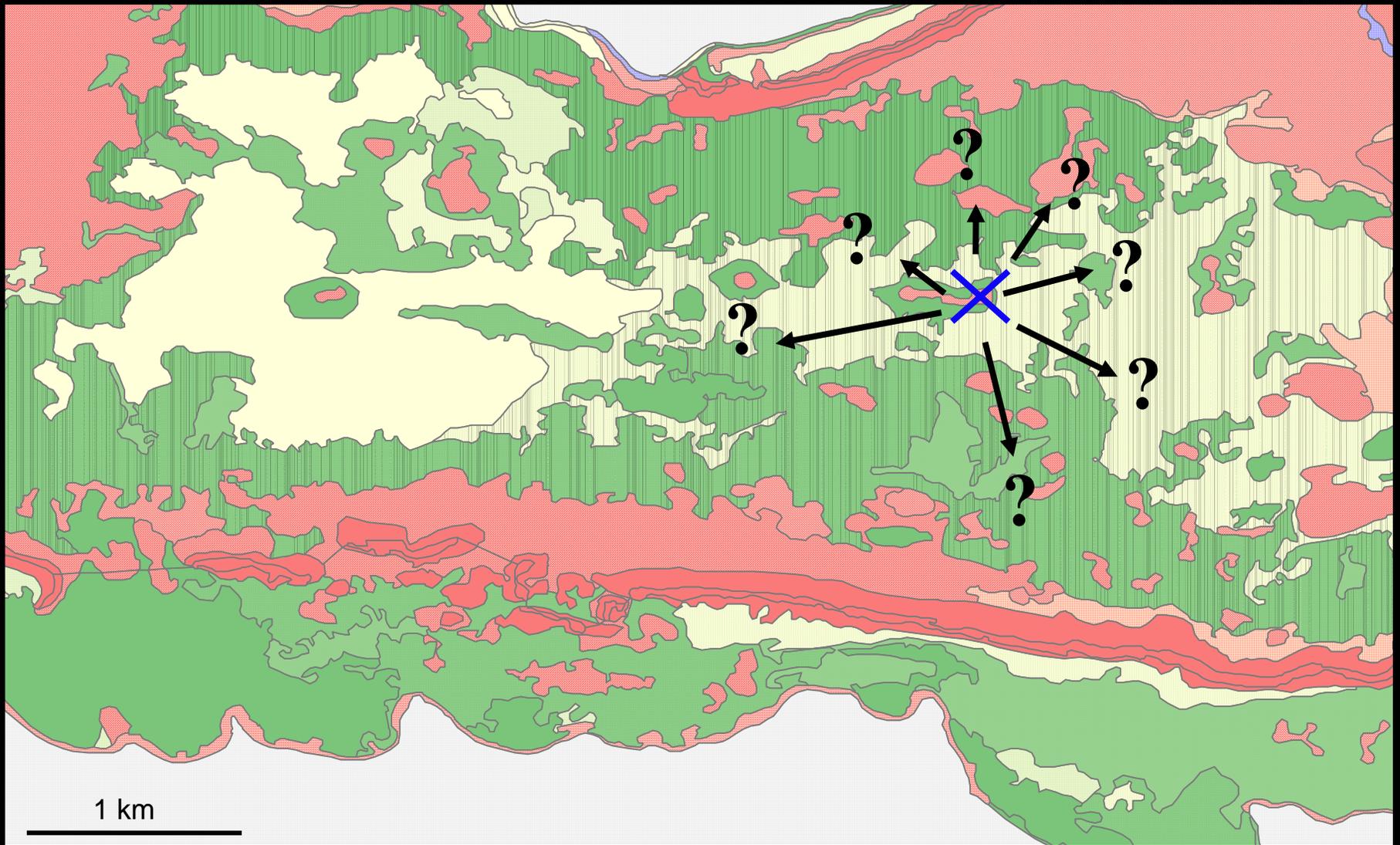


Improve Spatially Explicit Management Strategies

- Marine Protected Areas
- Essential Fish Habitat
- Can't collect fine-scale metrics everywhere
- Can collect landscape variables everywhere

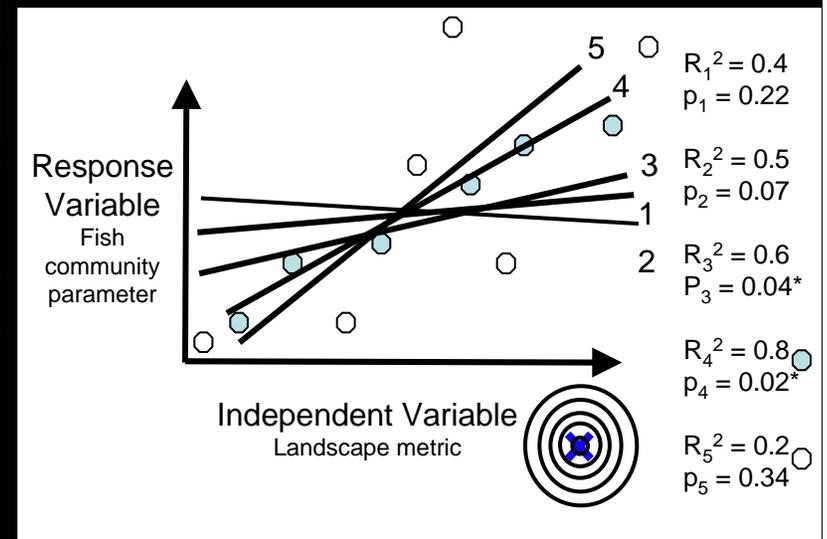
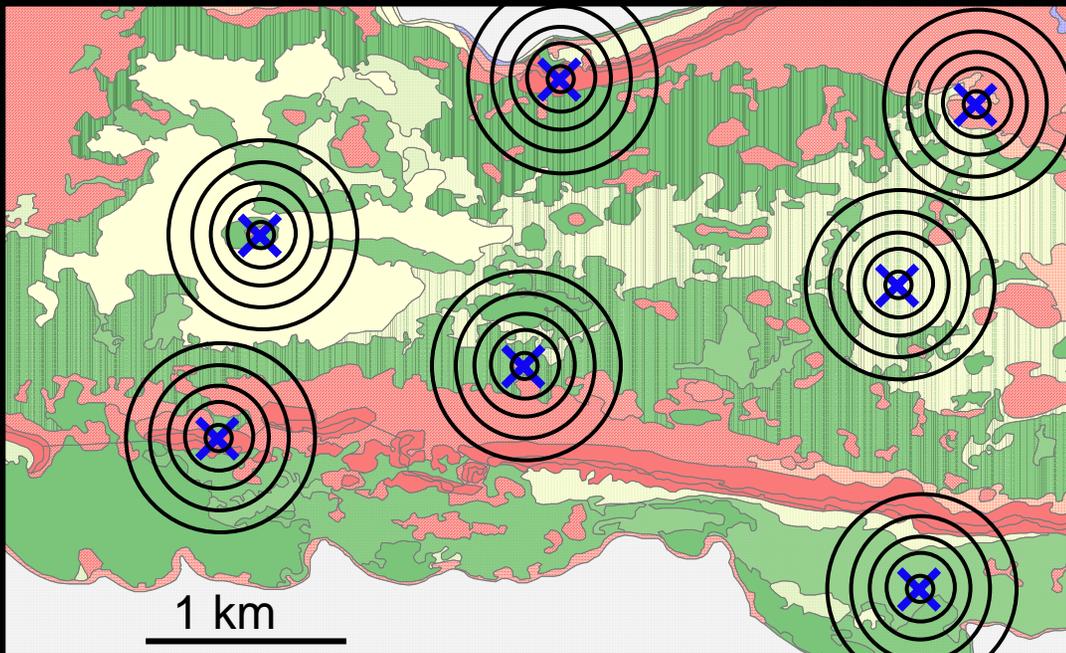


Seascape ecology of a coral reef: Influence of thematic and spatial resolution of benthic maps



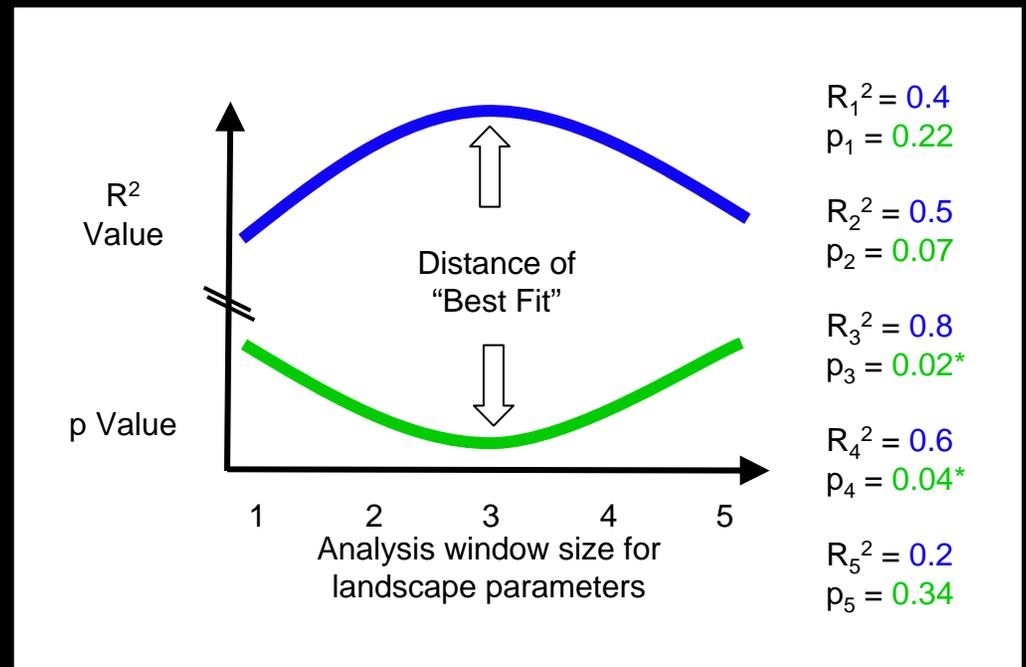
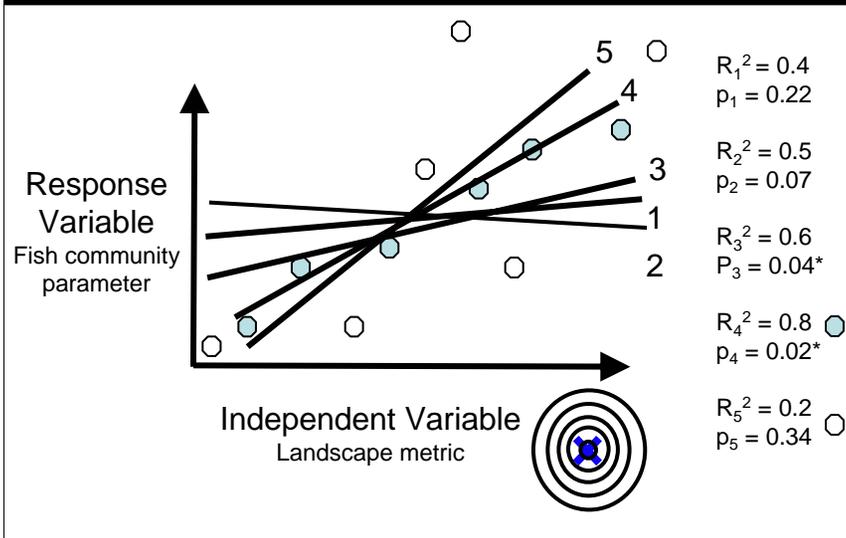
Identify relationships between fish and their landscape

- Blue “X” denote fish survey site
- Black circles indicate sizes of landscape calculations



Identify relationships between fish and their landscape

- Blue “X” denote fish survey site
- Black circles indicates sizes of landscape calculations



Seascape ecology of reef fish at Buck Island Reef National Monument, St.Croix, US Virgin Islands

Two examples

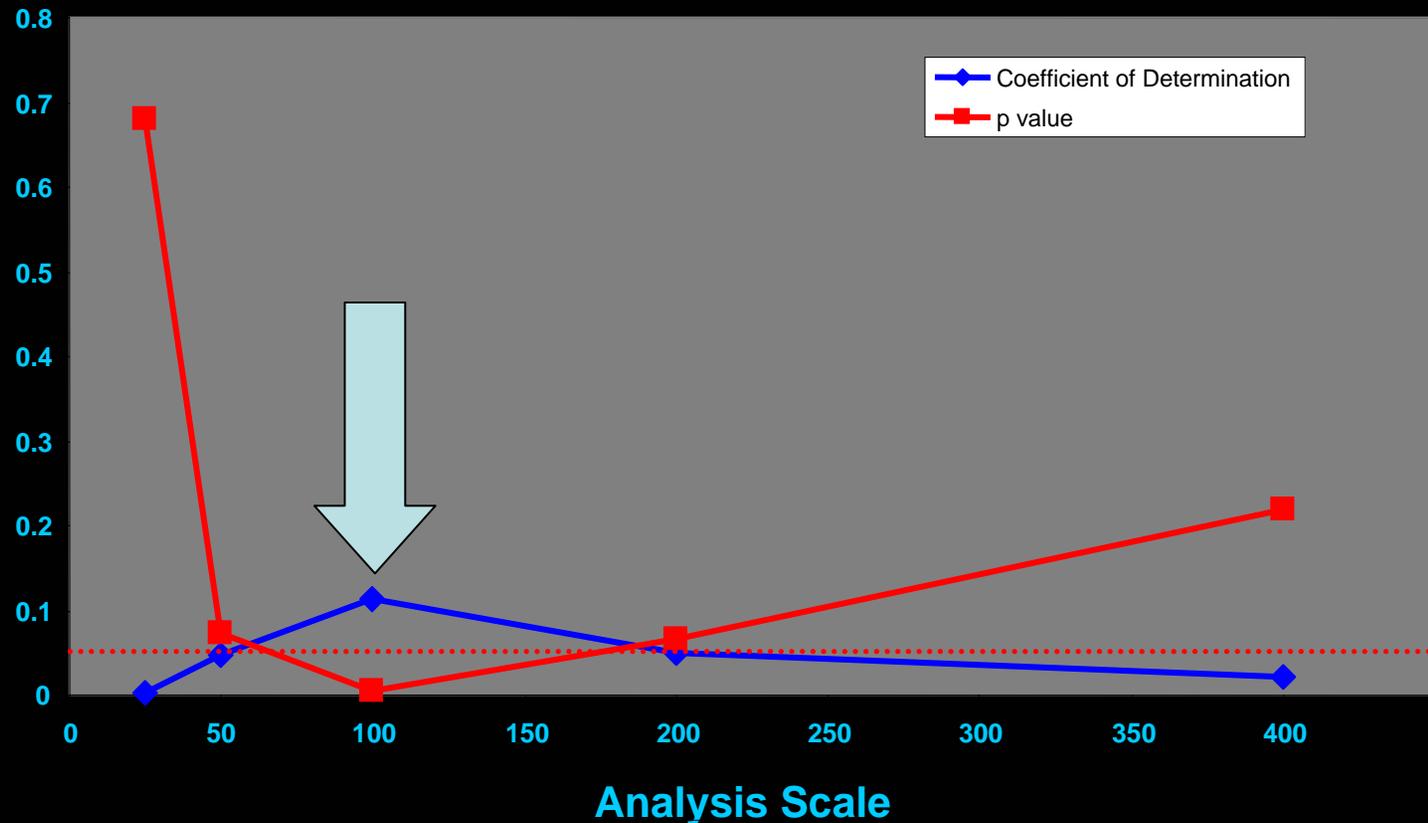
1. Fish richness on sand * hard bottom area- Linear Regression
2. Fish diversity on reefs * area of seagrass- Rank Correlation



Seascape ecology of reef fish at Buck Island Reef National Monument, St. Croix, US Virgin Islands

Example 1 Fish Richness on Sand * Area of Hard Bottom - Linear Regression

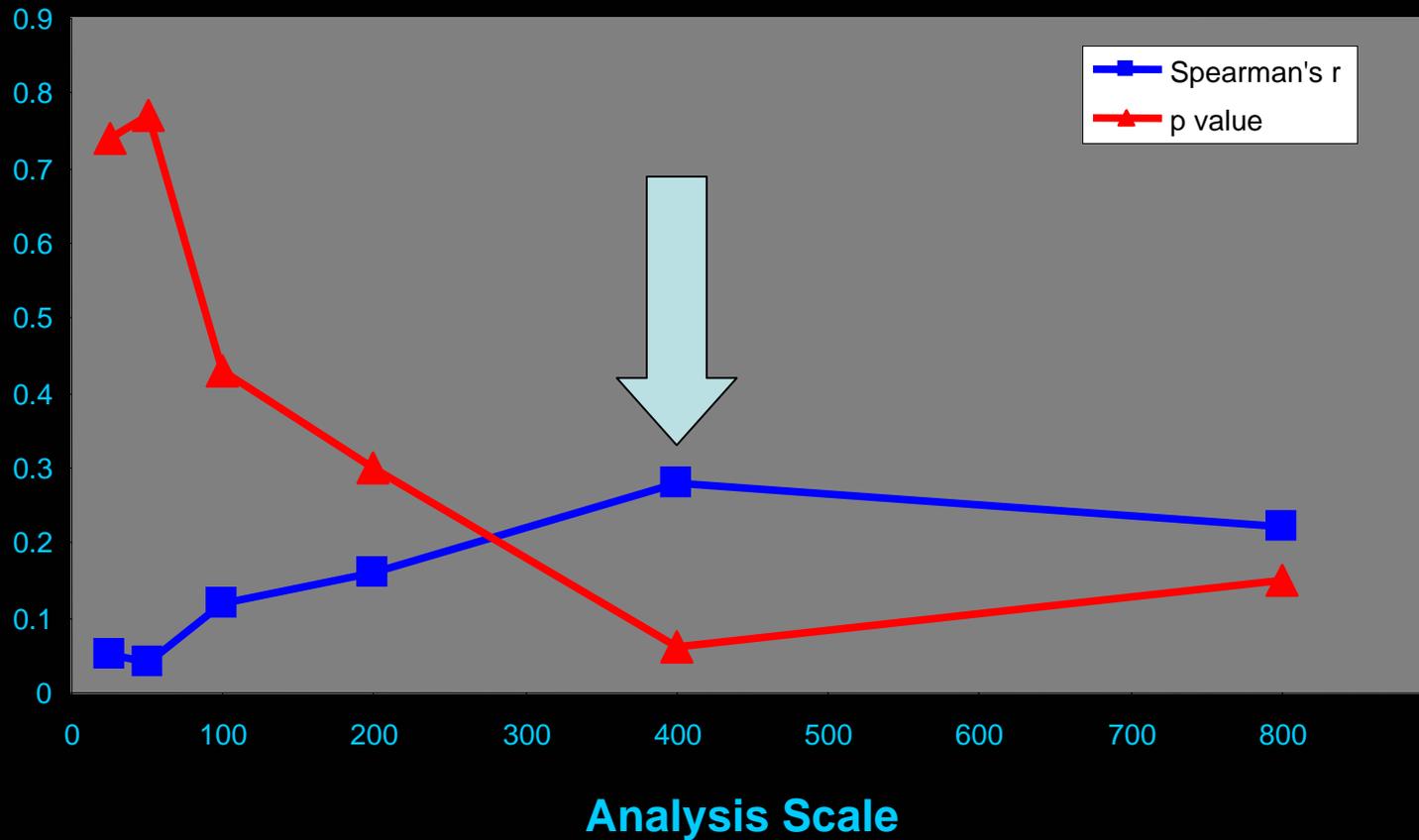
Analysis Scale (m)	25	50	100*	200	400
Coefficient of Determination	0.002	0.046	0.112*	0.049	0.022
p value	0.68	0.074	0.004*	0.066	0.218



Seascape ecology of reef fish at Buck Island Reef National Monument, St. Croix, US Virgin Islands

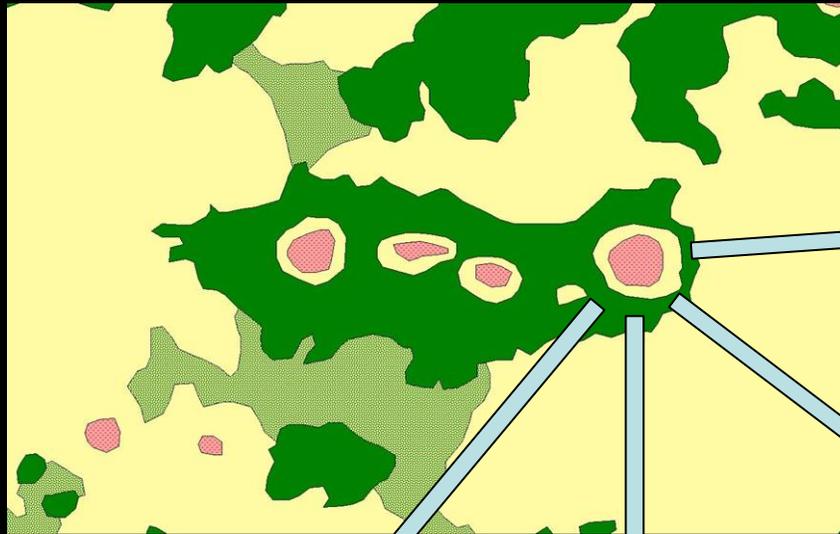
Example 2 Fish Diversity on Reefs * Area of Seagrass- Rank Correlation

Analysis Scale (m)	25	50	100	200	400*	800
Spearman's r	0.05	0.04	0.12	0.16	0.28*	0.22
p value	0.74	0.77	0.43	0.3	0.06*	0.15



Seascape ecology of reef fish at Buck Island Reef National Monument, St.Croix, US Virgin Islands

Remote sensing view vs Fish eye view



Variability due to fine-scale
Variability due to broad-scale

Summary

1. Establishing a baseline inventory of reef fish inside and outside BIRNM
2. Described a technique to identify patterns between fish and their landscapes



acknowledgments...

This project was made possible by NPS and NOAA funded partnership projects. Special thanks for the “hard field labor” of many individuals that was required to collect the large data set that makes this analysis possible. Special thanks to the NOAA Biogeography Team for providing a fun atmosphere of shared ideas that fostered the creative seascape analyses used here and elsewhere in our work. Thanks to NPS for encouraging and supporting the research aspects of this inventory activity in their back yard.

